Space Weather Technical Forecast

Issued on Tuesday, 23 August 2022 at 13:17 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Active fluence likely persisting throughout. Slight chance of R1 from AR3085.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low, with occasional C-class flares, mostly from AR3085. There are six sunspot regions on the visible disc, three of which are currently unnumbered. The largest and most complex region is AR3085, now classified as Dao/Beta-Gamma. This region continues to grow, becoming more elongated although some spots have vanished from the central part. Another region worth of note is developing in the southeast quadrant, currently classified as Cro/Beta. This region is still small but growing in size, with proliferation of spots. All the other regions are small and inactive, or about to rotate off the western limb. No Earth-directed CMEs were observed.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR at L1, slowly declined through the period from 550km/s to 480km/s, as the influence of any recent weak coronal hole or transient enhancement decayed. The density was mostly average. The total magnetic field strength (IMF) Bt, was generally weak, at 5-7nT, with only negligible fluctuations from the north-south component. The phi angle was negative (towards the Sun). Geomagnetic activity was Quiet (Kp 0-1).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV), as measured by GOES-16, was at Background levels. The high energy electron flux (greater than 2 MeV) remained at High levels, with a peak of 3820 pfu at 22/1645 UTC. The 24-hour integrated electron remained above the the Active threshold (1e8 integrated pfu) throughout the period, displaying a slight rising trend. A value of 1.69e8 integrated pfu was observed at 23/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is forecast to remain Low, with only a slight chance of increasing to Moderate. AR3085 is the most likely source for this activity.

Solar Wind / Geomagnetic Activity: There was a slight chance of a glancing impact from a CME early on day 1 (23rd), however this is looking more and more unlikely. No other Earth-directed CMEs feature in this forecast. Solar winds are expected to slowly decline towards background levels otherwise, with geomagnetic activity remaining largely Quiet. A slight enhancement is possible at the end of day 4 (26th) under the influence of a small coronal hole but its impact on geomagnetic activity should be minor, with perhaps an Unsettled or Active interval.

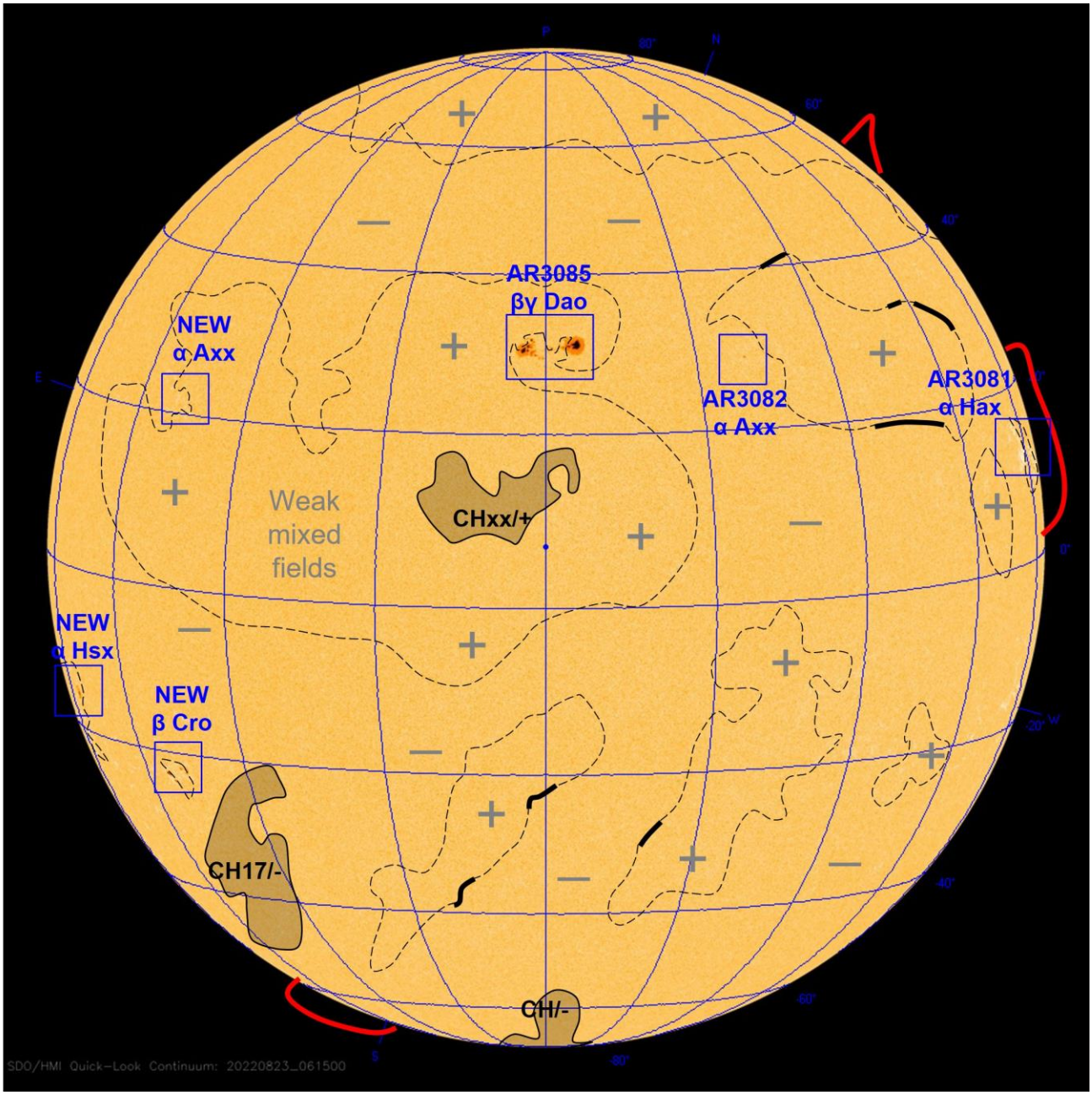
Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is forecast to remain at Background levels. The high energy electron flux (greater than 2 MeV) is currently at High levels and, in the absence of any CME arrival, is expected to persist largely at this level, only gradually declining later in the period. Any CME arrival could result in a drop out

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

in flux, however this is now very low confidence. Consequently the associated 24 hour fluence is expected to remain at Active levels throughout, perhaps with a declining trend later in the period.

Figure 1. Solar Analysis Valid 23/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

Geomagnetic Storms:

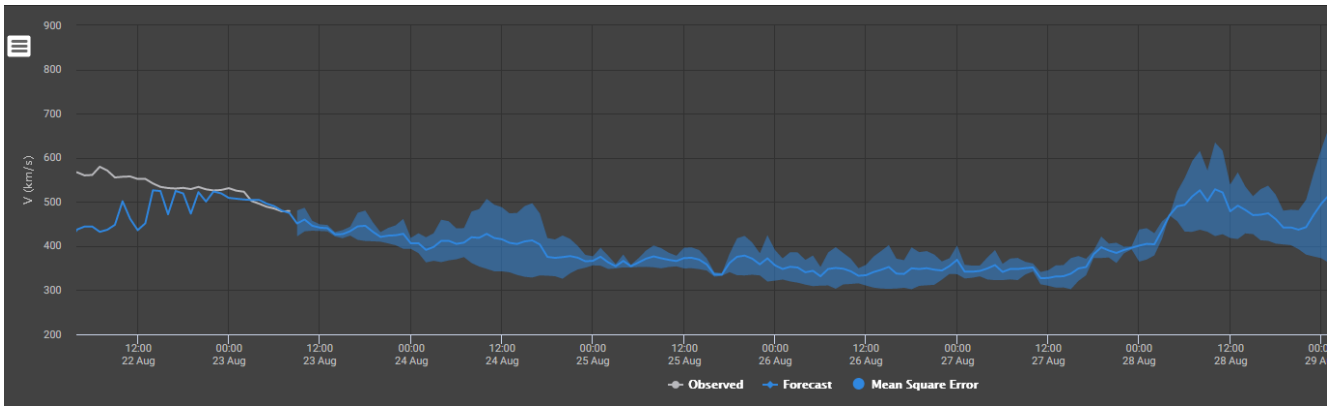
There was a slight chance of a glancing impact from the last of the CMEs originating from AR3078. This CME left the Sun on the 19th after an M1 flare and was expected to arrive at Earth on the 21/1800 UTC +/- 12 hours but this is now looking more and more unlikely. No other Earth-directed CMEs feature in this forecast.

Solar winds are expected to slowly decline towards background levels otherwise, with geomagnetic activity remaining largely Quiet. The MOSWOC Enlil indicates the arrival of a coronal hole fast speed stream late on day 1 and into day 2 (23rd and 24th) but this is not corroborated by satellite imagery and is considered to be an over-estimation of solar winds. A small coronal hole recently developed in a broad area of weak mixed fields but its current location would suggest a possible enhancement at the end of day 4 (26th), perhaps leading to an Unsettled or Active interval.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	1	1	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

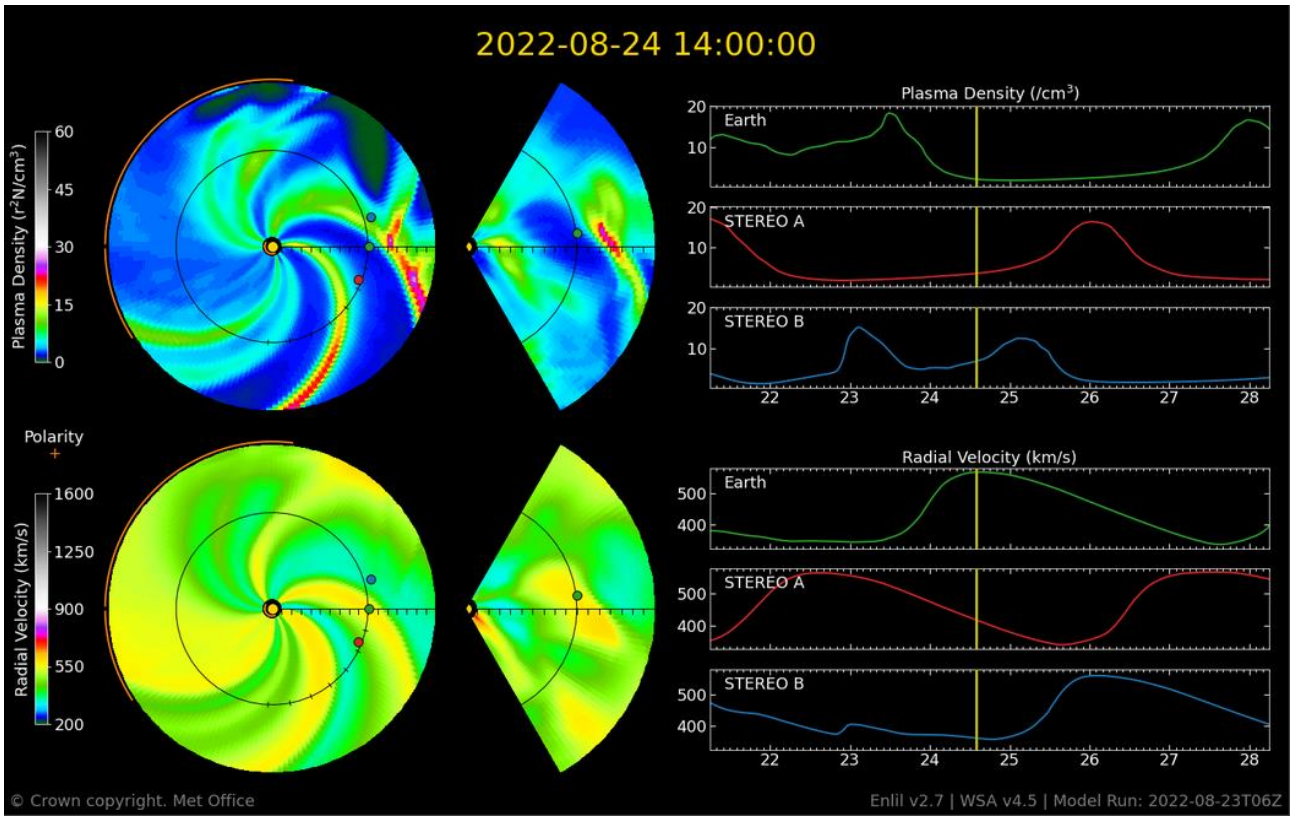
Figure 2: SWPM (Solar Wind Persistence Model), considered to be good guidance



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

Figure 3: Enlil showing anticipated enhancement on the 24th, which is currently not expected.



Radio Blackouts - X-Ray Flares:

There are six sunspot regions on the visible disc, three of which are currently unnumbered. The largest and most complex region is AR3085, now classified as Dao/Beta-Gamma. This region continues to grow, becoming more elongated although some spots have vanished from the central part. Another region worth of note is developing in the southeast quadrant, currently classified as Cro/Beta. This region is still small but growing in size, with proliferation of spots. All the other regions are small and inactive, or about to rotate off the western limb.

Low activity is expected to continue due to AR3085, with a slight chance of increasing to Moderate due to any M-flares that may occur.

Bright flux regions are visible on EUVI/AIA 195 imagery, indicating the presence of one or two potential active regions. These are expected to rotate soon on to the visible disc, perhaps boosting the flare probabilities.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	15	15	15	15
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 4: Latest X-ray Flux, as observed by GOES-16

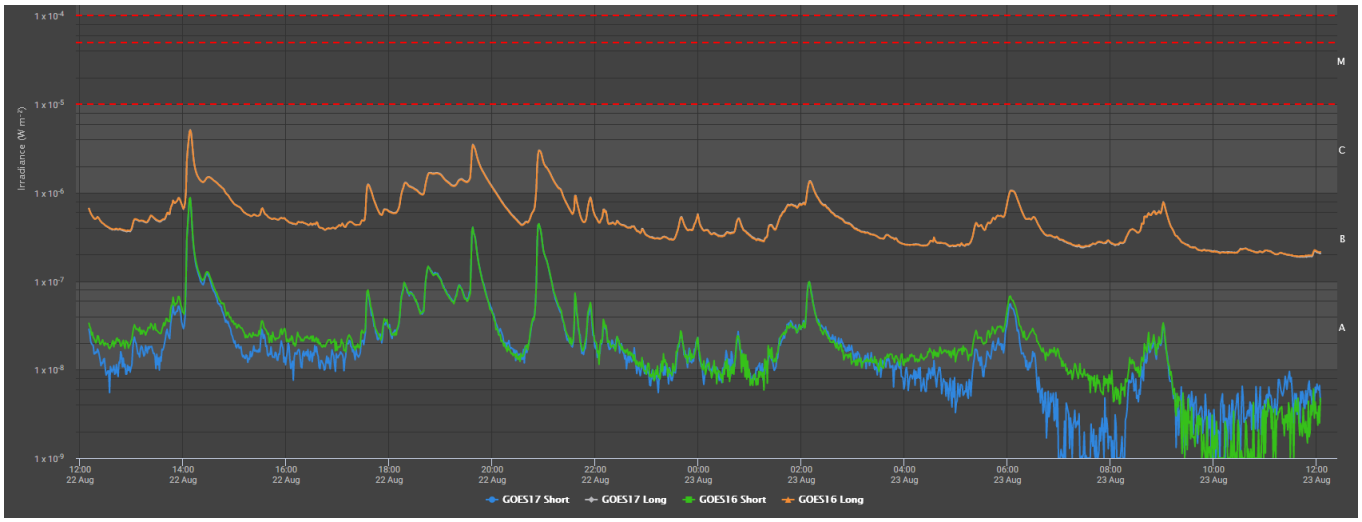
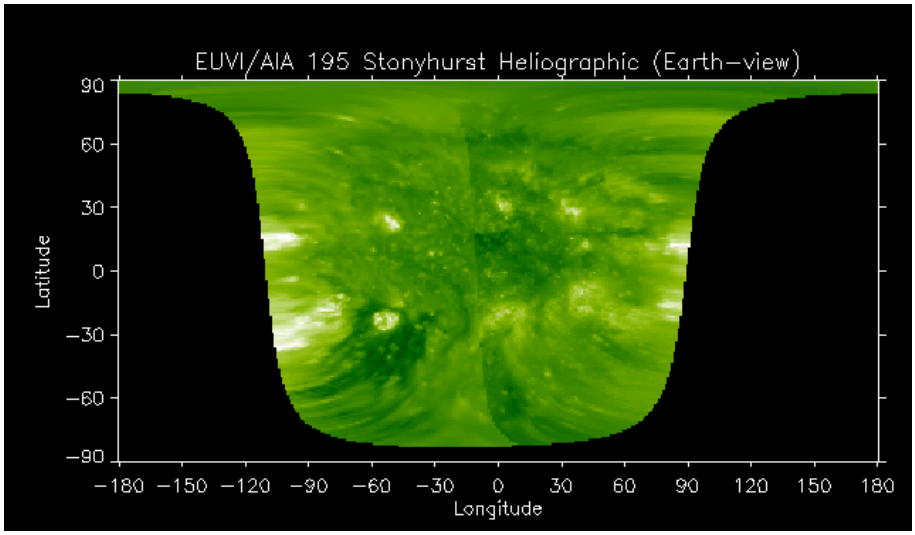


Figure 5: Latest EUVI / AIA 195 Å Stonyhurst Heliographic, showing bright flux region near 100 East



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as measured by GOES-16 is at background, and is expected to remain at this level.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

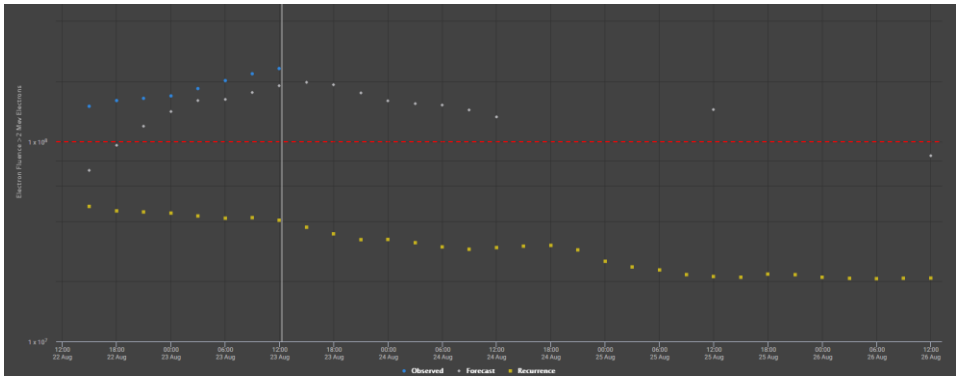
High Energy Electrons Event (≥ 2MeV):

The high energy (greater than 2 MeV) electron flux as measured by GOES-16 is currently high after recent coronal hole and CME enhancements to the solar wind environment. Any potential drop out of flux is dependent upon the arrival of a CME early on the 23rd, however this is now looking less likely. Furthermore, if it does occur, this will have lower potential impact the latter it does. Due to this generally high flux expected to either persist day 1 or potentially return after any such CME impact. Only a gradual reduction in peak values is then likely.

The associated fluence is expected to remain Active throughout, as supported by REFM. This is likely giving good guidance, unless the CME arrival occurs.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	Yes	100	80	70	70
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 6: Latest REFM model output



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.